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Bridging Gaps: Developing Sustainable Intergenerational Decision Making in Radioactive Waste Management

Proceedings of the 10th National Forum on Stakeholder Confidence (FSC) Workshop
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7-9 September 2016



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Radioactive Waste Management**

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List of abbreviations and acronyms

DETEC	Federal Department of the Environment, Transport, Energy and Communications (Switzerland)
ENSI	Nuclear Energy Inspectorate (Switzerland)
ENTRIA	Interdisciplinary analyses and development of evaluation principles
ENWD	European local network of radioactive waste dialogue
FSC	Forum on Stakeholder Confidence
GMF	Group of municipalities with nuclear facilities
HLW	High-level waste
KIF	Key information file
KISS	Keep it short and simple
HLW	High-level waste
KID	Key information file
L- ILW	Low- intermediate-level waste
NAGRA	National Co-operative for the Disposal of Radioactive Waste (Switzerland)
NEA	Nuclear Energy Agency
OECD	Organisation for Economic Co-operation and Development
RK&M	Preservation of records, knowledge and memory
RWMC	Radioactive Waste Management Committee (NEA)
SFOE	Swiss Federal Office of Energy (Switzerland)
SKB	Swedish Nuclear Fuel and Waste Management Company (Sweden)
SÖW	Socio-economic and environmental impacts
WIPP	Waste Isolation Pilot Plant (United States)

Foreword

After many years of nuclear power generation, the need to control and manage radioactive waste will persist for many decades. Programmes that manage waste, whether it has a low, intermediate or high level of radioactivity, have to address the processing, storage, transport and the ultimate disposal of the waste. While there is no debating that these aspects of radioactive waste management must be addressed, the decisions and the decision-making process can be controversial. Various challenges arise with this complex process which takes more than 50 years to complete and associates many technical and societal stakeholders.

Today's decision makers will not always be present to ensure that future generations will understand how the decisions were made or the full basis of today's confidence in the safety of the repository solution. The challenges associated with radioactive waste management present the need for a relationship between the policymakers who decide what will be done and local communities, as well as a relationship between the decision makers of today and younger generations who will be tasked with sustaining the waste management programmes' decisions. Waste management programmes must therefore find ways to bridge gaps when seeking sustainable intergenerational decisions that will not create undue burdens in the future.

Since 2000, the NEA has facilitated an open dialogue in the Forum on Stakeholder Confidence (FSC) where member countries analyse, document and develop recommendations for developing radioactive waste management programmes. The FSC includes government policy and regulatory officials, R&D specialists, implementers and industry representatives who discuss waste management programmes in a socio-political decision-making context. In September 2017 the FSC held its 10th National Forum on Stakeholder Confidence Workshop in Bern, Switzerland. Hosted by the Swiss Federal Office of Energy (SFOE), which is in charge of the process for the search of deep geological repositories for, the workshop grouped international visitors from 14 countries and Swiss stakeholders from national, regional and local levels.

The workshop provided a forum for the participants from around the world to learn from each other's experiences and to discuss what can be done today to take sustainable decisions which can be understood and accepted by future generations. Alongside the international visitors was a wide range of Swiss stakeholders, including the responsible Federal Councillor (representing Switzerland's executive branch), professionals from SFOE, the Swiss Federal Nuclear Safety Inspectorate (ENSI) and the Swiss implementer the National Co-operative for the Disposal of Radioactive Waste (Nagra), representatives of the siting regions and ten young people between the ages of 16 and 25.

These proceedings document the presentations by Swiss stakeholders about their site-selection process for deep geological repositories, and those by invited representatives of other programmes who shared their experiences. It summarises the roundtable dialogue sessions that allowed all the participants to mix and deepen the discussion of the themes

addressed by the workshop. It also presents feedback from an independent rapporteur and a summary of an international perspective from FSC members.

1. Executive summary

In September 2017 the Nuclear Energy Agency's Forum on Stakeholder Confidence (FSC) held its 10th National Workshop in Bern, Switzerland. Hosted by the Swiss Federal Office of Energy (SFOE), the workshop gathered international visitors from 14 countries and Swiss stakeholders from national, regional and local levels. They discussed what can be done today to take sustainable decisions on radioactive waste management which can be understood and accepted by future generations.

Jo-Ann Facella, acting Chair of the FSC, and NEA Director-General **William D. Magwood IV** welcomed participants to the workshop. Mr Magwood set the scene by emphasising the need to fairly solve a problem generated by a previous generation to avoid handing it down to future generations.

Switzerland is legally obliged to dispose of its low, intermediate and high-level radioactive waste within the country's borders, starting in this generation which was the beneficiary of nuclear technology. Within this obligation, safety ensuring permanent protection of human beings and the environment is of the highest priority. In Switzerland, it would be difficult to implement a large infrastructure project such as this without involving the cantons and the affected communities in the process. The federal administration is therefore compelled to involve a very broad range of stakeholders (including neighbouring German communities) in planning such a project at an early stage. This is achieved through a transparent stepwise process. At the end of the process, the Swiss Parliament will have to approve of the general licence, which is also subject of an optional popular referendum.

Federal Councillor **Doris Leuthard**, Head of the Swiss Federal Department of the Environment, Transport, Energy and Communications (DETEC), opened the workshop formally with her remarks. She recognised the presence the leaders and members of the regional conferences which play an important role in Switzerland's participative procedure to identify a site or sites for deep geological disposal facilities. She welcomed the presence of 10 young people aged 16 to 25 years representing the generation that will have to implement and possibly adapt some of today's decisions.

The present three-stage procedure specifically developed for repository site selection is an adaptation of a traditional Swiss land use planning instrument called the sectoral plan. In Stage 1, scientists identified six regions of the country (Figure 3.1) seen as potentially suitable hosts in terms of repository safety according to criteria set by the national regulatory authority. The regional conferences were created to take into account regional views. Two sites, Zürich Nordost and Jura Ost, have been recommended by Nagra for detailed investigation during the upcoming Stage 3. Councillor Leuthard was pleased to

note the federal government, the cantons and the municipalities have worked constructively as partners in this process. She commended the private citizens, non-governmental organisations and associations who are regional conference members, for their sustained effort to define an acceptable, legitimate and effective solution for radioactive waste management.

The first session of the workshop focused on the Swiss site-selection procedure, its actors, roles and process. **Roman Mayer, Vice-Director of SFOE further detailed the three-stage process** and then outlined the expected steps in decision making to take place after final site selection, anticipated in 2029 and upon validation by the Federal Council. Assuming a general licence was granted, an on-site laboratory would be created, followed (if a construction permit is granted) by the building of a deep repository. Upon being granted an operating licence, L/ILW could be emplaced from about 2050 and HLW from about 2060. The repository could be sealed upon a federal sealing order and then enter a phase of extensive monitoring as per a declaratory ruling.

Mr Mayer explained that regional participation is treated as a means of informing the local population throughout the siting regions. The regional conferences represent the interests, needs and values of the population so that these can be factored into the technical and political decision making around the repository project.

Hans Wanner, Director of the Swiss Federal Nuclear Safety Inspectorate (ENSI) spoke about the role of the federal regulator. ENSI holds overall responsibility for safety assessment of the future repository system, reviewing proposals, reports and licensing applications by the implementer Nagra. It acts as the safety competence centre of the Swiss Confederation.

Andreas Gautschi, Division Head Safety, Geology and Radioactive Materials, Nagra, presented the role of the implementer in the Swiss site-selection procedure. The Swiss energy law enshrines the “polluter pays” principle giving producers the statutory duty to take responsibility for waste management. Nagra was founded in 1972 by the waste producers. In 2015, Nagra proposed that Zürich Nordost and Jura Ost will be further investigated in Stage 3. These were comparatively viewed by Nagra to present the most favourable conditions for both a high-level waste and a low- and intermediate-level waste repository, which could in principle be constructed separately or “side by side”. The proposal is under review by safety actors. Nagra continues to co-operate with the regional conference members on a basis of mutual learning and trust.

The Commission of Cantons was created to ensure co-operation between government representatives of the siting cantons and the concerned neighbouring cantons and countries.

Each regional conference was presented to the FSC workshop by its (co-)president, vice-president or project leader, respectively **Ueli Müller** (Jura Ost), **Jürg Grau** (Regionalkonferenz Zürich Nordost), **Hanspeter Lienhart** (Regionalkonferenz Nördlich Lägern), **Hans Fellmann** (Plattform Jura-Südfuss), and **Kurt Margadant** (Plattform Wellenberg). Regionalkonferenz Südanden has suspended its work and did not participate in the workshop.

The regional conferences are composed of communal authorities, local organisations and interested citizens from the six siting regions for a total of 540 members. In all, 199 communities (including some in Germany) are involved, representing some 710 000 residents. Each of the six conferences is supported by an administrative office and shares the same required structure of management and three workgroups dealing

respectively with surface facilities, socio-economic and environmental impacts, and safety. These groups have a frequent schedule of meetings to discuss and develop siting issues.

Political scientist **Claudia Alpiger** (University of Bern) presented her doctoral research evaluating the ongoing regional participation procedures with 55 indicators. Among the recommendations made on this basis were: facilitate the participation of non-expert/militia volunteers with better scheduling, readable summaries, and compensation, intensify exchanges between the regional conferences and offer more attractive open events to garner broader involvement of the general public; better integrate women, immigrants and young people; seek to represent long-term and future interests to balance short-term interests.

On Day 2 of the workshop **David Brazier** from the United Kingdom's Environment Agency and member of the FSC Core Group introduced the first topical session, which focused on gaps in knowledge between experts and non-specialists as well as between those alive today and future generations.

Erik Setzman of Sweden's Nuclear Fuel and Waste Management Company (SKB) spoke about the NEA Preservation of Records, Knowledge and Memory (RK&M) research group. It has worked since 2011 to craft international, consensual guidance on how to fulfil the responsibility of current generations to inform future generations about sealed engineered facilities for the final disposal of radioactive waste. Mr Setzman presented the concept of the "key information file" or KIF. This will be a compact and non-technical record, widely distributed in many different types of archives internationally, in both print and electronic formats, so that it can remain accessible, readable and understandable for even far-future generations. It will point to other more detailed records about the repository, and where these can be found in permanent storage.

Marie Berggren from the Municipality of Östhammar, Sweden which has been involved in the site-selection process for a deep geological repository for spent nuclear fuel for more than 20 years. She highlighted the following factors that supported this long engagement: clearly defined roles for the implementer, the regulatory authorities, and the municipality; a voluntary process making it possible to step out at any time; financing from the national Nuclear Waste Fund. The municipality developed a set of statements framing their involvement: Long-term safety is the paramount issue; the community is an asset to the process and wants to be an active party from start to finish; conditions must be clearly stated before the municipality will take decisions or give permission; the community wants to understand the assessments, judgements and decisions of the authorities. Östhammar municipality is working now with SKB and many other actors including young people to develop the story of the repository to be communicated to the future generations.

Workshop participants then separated for roundtable discussions, grouping delegates from different countries and profiles with the Swiss stakeholders. They discussed the difference between information and knowledge, how to maintain and save knowledge and information, and how to bridge knowledge gaps. Their recommendations included inter alia:

Responsibilities as to which organisations maintain knowledge and know-how, and/or preserve key information for radioactive waste management should be clearly defined.

Knowledge-keeping and financial commitments should be locked in and independent of reversible political decisions.

Lucie Steinerová of the Czech Republic Radioactive Waste Management Authority, member of the FSC Core Group, introduced the second topical session focused on ensuring the sustainability of decisions taken today and intended to last for generations.

Lucy Bailey of Radioactive Waste Management, United Kingdom spoke as the Chair of the NEA's Integration Group for the Safety Case. She presented the role of the repository safety case in sustainable decision making. A safety case is "a formal compilation of evidence, analyses and arguments that quantify and substantiate a claim that the repository will be safe"; it is "compiled and presented at certain stages of a stepwise repository development programme with an aim to inform decision makers whether adequate information is available so that decisions to proceed to the next step can be made". Ms Bailey emphasised the need to use plain language and to build up trust between the technical specialists and the interested stakeholders to ease dialogue about the complex safety case information.

Gaston Meskens from the Belgian Nuclear Research Centre and University of Ghent then spoke about ethics and the future generations. He suggested that today's decisions inevitably reduce the ability for self-determination by future generations and impose today's moral vision on the future. In this view, responsibility towards future generations is to seek sustainable development (preserving resources for the future) but especially, fairness in the actual decision-making processes. Today's society should ensure that today's decisions can be explained with peace of mind as "the best we could do", and for this, preserve records of present-day dialogues. He suggested that lifting time pressure and adding flexibility can contribute to taking good decisions.

Peter Knoepfel of the University of Lausanne then spoke about the configuration of actors in national nuclear waste disposal siting policy. He mapped three sets of actors: political administrative authorities who develop and implement policy; end beneficiaries who experience the negative effects of the problem to be solved by the policy; target groups that cause the problem. The professor urged special attention to the negatively and positively affected third parties associated respectively with the target and beneficiary poles. These groups should be taken seriously and the solution should bring positive consequences to the negatively affected groups. Compensation is one tool for this, and it should be determined by an objective cost/benefit analysis combining not only physical damages but also lost opportunities or revenues. These may be better understood in the future and so monitoring should take place.

Roundtable discussions then considered how to judge decisions over time, the impacts on sustainable decision making of different processes and political systems, and what would be a fair and sustainable decision on managing radioactive waste. Recommendations included inter alia:

To be fair towards future generations, the present generation has to look for a solution to the nuclear waste problem now. This solution has to be the best presently achievable solution and needs to include the option of retrievability, as described by the following attributes:

- The solution has to aim for long-term positive effects and find an intergenerational balance between benefits and burdens.
- A well-designed, clear and transparent process is very important to explaining the outcome later on.
- The process has to be flexible but also sufficiently robust to withstand rapid political change or populist movements.

- Debate and dialogue are crucial. All stakeholder groups should be involved and a continuing effort must be made to include the groups that are underrepresented in the process.

On Day 3 **Christine Pineda** of the United States Nuclear Regulatory Commission and member of the FSC Core Group introduced the final topical session on the intergenerational knowledge gap.

Michelle Beyeler, Bern University of Applied Sciences, and Nico van der Heiden, Swiss Association of Young Doctors, spoke about involving young people in radioactive waste management. Reviewing survey findings, Professor Beyeler concluded that it is very important to actively involve and inform young people if their support for geological disposal is wanted. Dr Van der Heiden offered recommendations for involving young people in local deliberations. Officials must not expect more than 5% representation. They should adapt the format and conditions of participation to young people's interests, habits and material possibilities. The process must be open, without foregone outcomes, the right to speak must be fairly guaranteed, and young people should be encouraged and told that "there are no stupid questions".

The round tables discussed the need to act now and the various barriers to getting people involved in radioactive waste management, then considered ways of engaging young people in particular. Among the recommendations were the following:

- Current knowledge and resources and the strength of running research efforts should not be underestimated. It cannot simply be hoped that future generations will be more clever. Plan the pessimistic way.
- Discuss environmental issues in general (e.g. global warming) in schools. Multiply the connections by including such issues, including radioactive waste management, in cultural products for children.
- Methods of participation must be adapted to young people. They have other priorities and things to do in the evening!
- Involve influencers, famous people whom it is interesting for the young people to meet. Engage young people themselves in communication and let them act as multipliers.
- Give due account to the opinions and inputs of young people. They need to see that their participation is meaningful and impactful.

At the end of the workshop feedback was offered by the three participant constituencies: young people, local Swiss stakeholders, and the international guests. Each shared a positive evaluation of the networking and discussions across boundaries and borders, saying that much was learnt and thanking the other partners. A future workshop could be improved by more lively talks (on the TEDx model) and by providing information on how each participating nation is handling its own radioactive waste management decision-making process. The young people and the local stakeholders both emphasised the need for concrete follow up to be sure that their participation adds something to the process. In particular clear efforts must be made to involve youth in the future steps of the Swiss repository development procedure.

Ulrich Smeddinck, assistant professor of law Technical University Braunschweig (Germany) as independent rapporteur then shared impressions of the workshop. He emphasised the need for transparency, admitting uncertainty as well as the emotional side of issues, and societal commitment to fairly solving problems created in the present generation. He pointed to good practice in dialogue, looking for diversity and keeping an

open mind and willingness to be changed by listening to others. He praised the quality of the discussions at the workshop, and invited all participants to act as bridge builders along the way to a repository for nuclear waste.

Stefan Jordi, Head of Regional Participation Service, gave final statements on behalf of the Swiss Federal Office of Energy. He summarised the importance of the Sectoral Plan and the safety criteria as well as the need for stakeholder engagement and flexibility. He recounted the crucial points of the selection process and how this workshop is a worthwhile contribution to the process as international exchanges on this topic are valuable and beneficial. He also expressed his thanks to those who planned and executed the workshop.

Yeonhee Hah, Head of the NEA Human Aspects of Nuclear Safety division, closed the workshop as representative of the NEA Secretariat of the FSC. She thanked the different participants and assured them that their viewpoints would be conveyed on the international stage during the January 2017 cross-cutting NEA workshop on stakeholder involvement in nuclear decision making. Ms Hah recalled the proverb: to go fast, go alone; to go farther, go together. She said that this is the belief of the FSC, and it is the means by which the NEA will work towards a better future.

2. Opening of the 10th National Forum on Stakeholder Confidence Workshop

Jo-Ann Facella, acting Chair of the OECD Nuclear Energy Agency's Forum on Stakeholder Confidence (FSC) chaired the 10th National Workshop on bridging gaps in the development of sustainable intergenerational decision making in radioactive waste management. She thanked the organisers, **Stefan Jordi**, and **Pascale Kuenzi**, of the Regional Participation Service (Radioactive Waste Disposal Section, Swiss Federal Office of Energy {SFOE}) and all of the Swiss stakeholders for their invitation. Ms Facella noted that representatives of 14 countries had travelled to the workshop for the opportunity to understand the Swiss approach, to share their own country experience, and to explore important questions faced by modern societies regarding the disposal of nuclear waste.

Federal Councillor **Doris Leuthard**, Head of the Swiss Federal Department of the Environment, Transport, Energy and Communications (DETEC), welcomed all participants and noted the presence of several high-level officials, and the leaders of the regional conferences, which play an important role in the Swiss site-selection procedure for the selection of deep geological repositories for radioactive waste. Councillor Leuthard said that she was especially pleased to welcome the participants aged from 16 to 25 years coming from various parts of the country, including potential siting regions. These young people represent a group which has hardly been involved so far but which will be called on to make important decisions in the future. She encouraged these participants to actively express their views during the workshop discussions.

Councillor Leuthard mentioned two driving forces in the management of radioactive waste. Switzerland has undertaken the legal obligation to ensure that low, intermediate and high-level radioactive waste is disposed of within the country's borders, as the firm responsibility of the present generation which was a benefactor of nuclear energy to apply nuclear technology. Within this obligation, safety is of the highest priority: it is viewed as absolutely essential to ensure that radioactive waste is stored in a manner that guarantees permanent protection of human beings and the environment.

Switzerland has been a member of the FSC since its establishment in 2000. A lesson learnt is that all the members share common principles and goals but there is no one-size-fits-all solution for the disposal of radioactive waste. Factors such as history, political system and culture, the size and location of country all play a role. As a lawyer and elected politician, Councillor Leuthard highlighted the need to make sustainable decisions today that will be understood and accepted by future generations, and give them sufficient scope for making their own decisions if circumstances should change. The key to such decision making is participatory involvement, which Councillor Leuthard called "a central aspect of Switzerland's *raison d'état*".

Councillor Leuthard relayed that in Switzerland, the federal government holds the formal responsibility for the process to find a deep geological repository for radioactive waste from nuclear energy production, medical, industrial and research applications. However,

in the Swiss system of direct democracy a project of this nature can only be implemented if the involved cantons (regional territorial units) and municipalities are involved in the process.

To optimise such a large project, the federal administration is compelled to involve a very broad range of stakeholders at an early stage well before site selection. All three state levels get the chance to provide input, express interests and concerns, and formulate their particular requirements. The Councillor noted that involvement in repository siting actually stretches beyond national borders and includes German stakeholders.

Analysing the Swiss Confederation's successful achievement of major projects, such as constructing the world's longest railway tunnel, Councillor Leuthard emphasised the division of powers and the direct active participation of the public concerned. While requiring time, a participatory process can deliver a common understanding and a compromise solution. She noted that when the process is properly conducted, there are no winners and losers at the end, but optimised projects that can be accepted even by opponents, if at times reluctantly.

The present three-stage procedure is an adaptation of a traditional Swiss spatial planning instrument called the sectoral plan. It encompasses a transparent, scientific approach with clear, foreseeable steps, includes a strong participatory component, and culminates in political decision. The Councillor remarked that "technically we can solve it; through procedure we can solve it; finally it's important to have political will, political acceptance and transparency." In Stage 1, implementer identified six regions of the country seen as potentially most suitable hosts in terms of repository safety. To take into account regional views, so-called "regional conferences" were established with the intention to discuss the placement of the needed surface facilities, to explore risk and safety issues and to develop an understanding of the actual impacts of a repository on its future host community. Councillor Leuthard was pleased to note the federal government, the cantons and the municipalities have worked constructively as partners in this process. She commended also the private citizens, non-governmental organisations and associations who are regional conference members, for their sustained effort to define an acceptable, legitimate and safe solution for radioactive waste disposal. She acknowledged that the process is long and potentially frustrating while the decision remains in the distant. Currently, the interest in this complex mission is low among some segments of the population. However, Councillor Leuthard foresaw that general curiosity and involvement will increase as the site search becomes more specific in Stage 3.

The Federal Councillor responded to a question by stating that Switzerland compares well with other countries in moving towards a solution. She pointed out the advantages of NEA membership and exchanging knowledge with other member countries to develop good processes, identify costs, and gain expertise on technical issues including the future dismantling of nuclear plants. Councillor Leuthard closed with the hope that the FSC workshop would yield instructive, informative, and productive discussions for all attending – and perhaps as well, elements for identifying potential solutions in delegates' own countries.

NEA Director-General William D. Magwood IV then addressed the assembly, stating that he was pleased to be in Switzerland which he had last visited as a United States Nuclear Regulatory Commissioner. Today he spoke as the head of an international agency grouping 31 countries representing the most advanced nuclear infrastructure in the world, which work together to try to solve difficult challenges. Mr Magwood noted that the NEA member countries have many common interests as well as divergences, and at

the end of the day their common commitment is to ensure that the public they serve is safe.

Mr Magwood identified with the young people attending the workshop, recalling that he started his work in the area of radioactive waste management at the age of 25. Looking back briefly over this career, which included research on transmutation, he noted that while geologies have been more extensively analysed, the technology and the science have not fundamentally changed. Deep geological disposal of nuclear waste is still the reigning consensual solution and, Mr Magwood judged, is not a vast technical challenge. It requires work by scientists and by regulators, but this is not an insurmountable task. The Director-General interpreted that the reason for so little progress in advancing towards disposal is that in many countries, there was a failure to fully engage publics in the discussion through a participatory process. He told the Swiss stakeholders that many countries are watching to learn from the sectoral plan process, just as they are watching Sweden and Finland which are well on the way to establishing disposal solutions.

Mr Magwood emphasised the need to fairly solve a problem generated by a previous generation to avoid handing it down to future generations. He invited country delegates to be aware of other major meetings organised by the NEA, including the December 2016 International Conference on Geological Repositories, as well as the cross-cutting January 2017 workshop on stakeholder involvement in nuclear decision making.

Mr Magwood recalled an important lesson he learnt as a regulator: that simply giving information and walking away is the wrong approach. Policymakers, regulators, and implementers have to be able to dialogue with the public. The FSC workshop provides such an opportunity. He closed by thanking the Swiss stakeholders and especially the young people for their willingness to dialogue with delegates from 14 countries, and wished all a fulfilling workshop.

Ms Facella introduced the FSC. The NEA Radioactive Waste Management Committee created the Forum in 2000 to develop common understanding of societal issues in the areas identified in its programme of work available online. Its members are government policymakers, regulatory officials, research and development professionals, and waste management implementers. They include many individuals with direct responsibility in their own country for engaging stakeholders, looking at ways to address problems and find solutions, learn and make decisions together. The FSC enhances the usefulness of its activities and its many publications by engaging with other organisations within and outside the NEA. The acting Chair presented FSC national workshops as a very important component of a “lasting journey of learning”. The workshops are an opportunity for stakeholders in one country to present and analyse their own radioactive waste management approach in a peer setting. The external participants from around the world intend to add to the learning by giving feedback and sharing their own experience. Ms Facella recalled that her home country Canada benefitted a great deal from hosting the 2nd workshop early in the nation’s siting process. Each FSC workshop focuses on specific topics, discussing them in depth and taking advantage of meeting together to create a joint exploration. An independent, neutral rapporteur circulates and observes the work of the discussion groups and provides feedback at the end of the workshop.

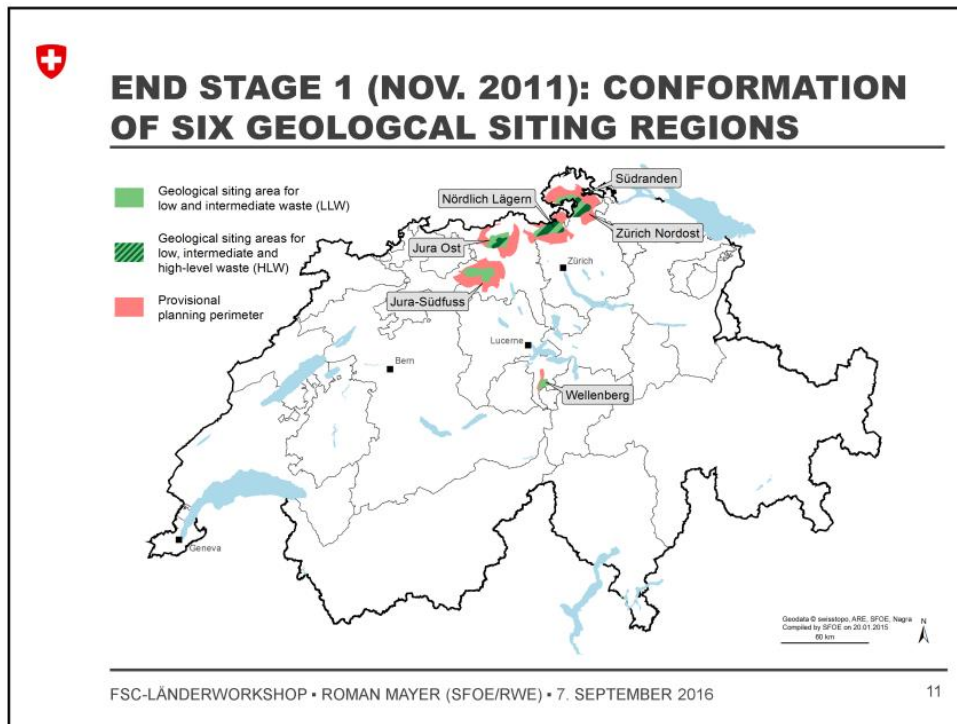
3. The Swiss site-selection procedure: Actors, roles and process

The site-selection process and federal-level actors

Roman Mayer, Vice-Director of Swiss Federal Office of Energy (SFOE) explained the Swiss site-selection procedure for the disposal of nuclear waste in deep geological repositories. SFOE is the national organisation in charge of in this procedure, using an adapted spatial planning instrument (the sectoral plan). This instrument allows the federal level to co-ordinate federal infrastructure projects with the cantons. Besides SFOE, other federal departments or agencies have duties in the process as well. The technical implementer is Nagra, a co-operative established by the operators of nuclear power plant and the Swiss Confederation. The cantons (states) also have an important procedural role. Finally, six regions (cutting in some cases across cantonal or even national borders) are prime participants in the siting procedure.

These siting regions were identified in 2008, based on a “white map” of Switzerland. In the completed Stage 1 of the site-selection procedure, Nagra conducted a systematic search for potential siting regions for deep geological repositories. The search for sites was based on pre-defined safety criteria, requirements relating to engineering feasibility and the steps defined in the sectoral plan for the selection of siting regions. It proceeded from large geologically suitable areas in the whole of Switzerland through the localisation of preferred host rocks at suitable depth and with sufficient thickness to identification of potential geological siting regions.

Figure 3.1. The six geological siting regions selected in Stage 1 of the Swiss procedure



Presentation by R. Mayer, SFOE, 7 September 2016

Nagra proposed the following siting regions in autumn 2008: Zürich Nordost, Nördlich Lägern and Jura Ost for deep geological repositories for HLW and L/ILW and, in addition to these, Südranden, Jura-Südfuss and Wellenberg for an L/ILW repository (see Figure 3.1). A provisional planning perimeter at surface level was identified for the placement of the surface facilities at the same time. The authorities and other technical bodies reviewed Nagra's proposals and the cantons, affected federal offices, neighbouring countries and interested organisations and individual persons had the opportunity to express their views as part of a public consultation process (public hearing). The Federal Council decided in 2011 to adopt all six proposed siting regions into the process and thus initiated the start of Stage 2.

The officials and the population of these siting regions have participated directly in the selection procedure from the beginning of Stage 2 through the so-called "regional conferences". These are called „Regionalkonferenz Jura Ost“, „Regionalkonferenz Zürich Nordost“, „Regionalkonferenz Nördlich Lägern“, „Plattform Jura-Südfuss“, „Plattform Wellenberg“, and „Regionalkonferenz Südranden“. (The latter organisation has suspended its work and did not participate in the workshop.)

The goal of regional participation is to secure the early involvement of stakeholders, being set up in Stage 1 (2009-2011) immediately after the identification of each site under consideration by the implementer. According to Mr Mayer, this participation is treated as a means of informing the local population throughout the siting regions. The regional conferences have a specific task of representing the interests, needs and values of the

population so that these can be factored into the technical and political decision making around the repository project.

The regional conferences are composed of communal authorities, local organisations and interested citizens for 30–120 members for each regional conference and a total of 540 members for all six regional conference. In four regional conferences, representatives of German communities are included due to the geographic proximity. In all, 199 communities are involved representing some 710 000 residents of the combined regions. Each of the six conferences is supported by an administrative office and shares the same required structure of management and workgroups. These meet frequently to discuss specific issues. The surface facilities workgroup was tasked with assessing proposals for the placement of surface facilities by Nagra with the question: “which sites could be used for the construction of surface facilities... if a deep geological repository were built in our region?”. The socio-economic and environmental impacts group seeks replies to the question “which projects and measures could be used to promote development within the region... if a deep geological repository were built in our region?”. The Safety Work Group was not required, but constituted in all siting regions in order to discuss issues related to safety.

After an intensive collaborative process with the regional conferences in the ongoing Stage 2, Nagra identified at least one suitable siting area for the repository surface facility in each of the siting regions.

In 2015, Nagra proposed that Zürich Nordost and Jura Ost be retained for further investigation in Stage 3. These were viewed by Nagra to present the comparatively most favourable conditions for both a high-level waste and a low- and intermediate-level waste repository, which could in principle be constructed separately or “side by side”. The proposal is under review by safety actors.

Mr Mayer outlined the expected steps in decision making to take place after final site selection, anticipated in 2029 and upon validation by the Federal Council and the Parliament decision. Assuming a general licence was granted, an on-site rock-laboratory would be built, followed (if a construction permit is granted) by the building of a deep geological repository. Upon the grant of an operating licence, L/ILW could be emplaced from about 2050 and HLW from about 2060. Throughout the operation of these test and definitive installations, scientific observations would be conducted. The repository could be sealed upon a federal sealing order and then enter a phase of extensive monitoring as per a declaratory ruling.

The siting and eventual construction processes and operation represent a decades-long time frame. Mr Mayer commented that knowledge gaps thus result, separating involved and non-involved persons, and persons living now or in the future. Such gaps – if not bridged – could make decisions unsustainable. In this light, SFOE and the various Swiss stakeholders have committed to seeking ways to make sustainable decisions which can be understood and accepted going forward, and which leave future generations with the ability to take their own decisions that meet their own circumstances should there be a need.

Hans Wanner, Director of the Swiss Federal Nuclear Safety Inspectorate (ENSI) spoke about the role of the federal regulator in the Swiss site-selection process. ENSI holds overall responsibility for safety assessment of the future repository system, reviewing proposals and reports by the implementer Nagra. ENSI determined the safety criteria (such as the barrier effect and stability of host rock) of the sectoral plan according to

which all six sites involved in the current selection procedure were identified. It will perform the final assessment of the general licence application to be presented to Federal Council and the Parliament.

In the site-selection procedure, ENSI informs the media and the public about safety aspects and the activities of the Technical Forum on Safety which it co-ordinates. It makes its expert knowledge available to the federal, cantonal and communal authorities, the Cantonal Commission, the siting regions and the public. ENSI thus acts as the safety competence centre of the Swiss Confederation and as a contact point for all interested stakeholders.

Mr Wanner noted that the cantons are the owners of the nuclear power plants and therefore of the radioactive waste these produce. They delegated to Nagra their duty to find a site for disposal and implement the repository. Dr Wanner recommended that cantons should actively communicate with their populations about this ownership, dispel any image of victimisation by “ruthless profit-seeking electricity barons”, and explain to citizens that with the benefit of nuclear electricity they also received the duty to manage the waste. He stated that this would help in finding consensual solutions.

Andreas Gautschi, Division Head Safety, Geology and Radioactive Materials, Nagra, presented the role of the implementer in the Swiss site-selection procedure. Nagra, the National Co-operative for the Disposal of Radioactive Waste, was founded in 1972 by the waste producers. The Swiss energy law enshrines the “polluter pays” principle giving producers the statutory duty to take responsibility for waste management. Nagra is financed to 97% by the five nuclear power plants, and to 3% by the federal state to cover the disposal of the waste of medical, industry and research. Financing is shared with the consumer through inclusion in electricity rates at approximately 1 Rappen or Swiss cent per kilowatt-hour.

Nagra’s proposals are reviewed by ENSI and the Federal Safety Commission. The co-operative employs 100 persons, most of whom are geoscientists, engineers, physicists, or technicians. Nagra conducts research in two underground rock laboratories in Switzerland: its proprietary installation at Grimsel for the study of crystalline rocks, and the international project installation at Mont Terri for the investigation of clay rocks.

The acronym “Nagra” has been humorously interpreted in German as “useless drilling into the globe with huge effort”. **Mr Gautschi** stated that Nagra’s scientists have the task of convincing people that the first word is “useful”. In line with international consensus, Switzerland determined the feasibility of disposing of its radioactive waste in stable geological formations to ensure the protection of human life and the environment over the long periods during which the waste is toxic (between 100 000 to one million years) in 2006. Radioactive waste has been produced for 40 years and is currently stored at an interim storage facility or at reactor sites. Decommissioning will produce large quantities. The expected volume for a 50-year period is about 90 000 cubic metres of L/ILW waste and less than 10 000 cubic metres of HLW.

In the current site-selection procedure, Nagra acts as the technical scientific competence centre for the producers to narrow down the range of potential sites for the disposal of each category of waste, separately or in a combined installation. Mr Gautschi reviewed the type of data used at each point in the stepwise scientific programme assessing the stability of potential host rocks, their low permeability and their extent and thickness. Stage 3 will yield more field data such as 3D seismic assessments. The general licence will also be prepared.

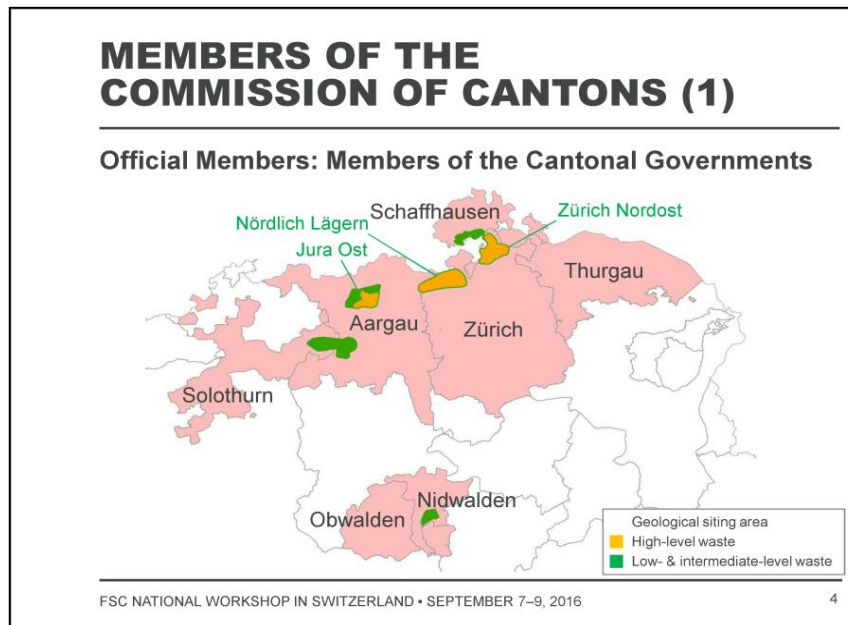
Mr Gautschi offered the opinion that Nagra's transparent publication policy helps build confidence. All reports, dating back to the first borehole of 1979, are online and all measurements and tests are documented and available to scientists and university researchers to freely draw on the data. The open extensive exchange of scientific data at national and international levels, and the critical scrutiny of the work through conferences and peer reviewed literature constitute, according to Mr Gautschi, "a good test of the quality of our science – we could not pass otherwise".

The division head also spoke positively of the co-operation with cantons and siting regions in the participative process, based on mutual trust. He told a success story of Nagra's contacting 1 600 landowners and obtaining land access consent from 90% of these on the strength of personal dialogues explaining why this access was needed. More broadly, transparency and fairness are crucial for local stakeholders to be able to accept a repository in their community. The siting process, Mr Gautschi said, has to be able to withstand detours, disagreements and debates on basic principles, within basic boundary conditions: "our duty towards future generations is to fulfil this environmental protection task without delay in Switzerland – we must not postpone taking action. The basis for moving forward already exists."

The cantonal level

Markus Kägi, Chair of the Commission of Cantons, presented the role of the cantons in the Swiss site-selection procedure. Switzerland is a federation of 26 cantons or states, of which six have been directly involved through Stage 2 of the repository siting procedure. The Commission of Cantons was created to ensure co-operation between government representatives of the siting cantons and the concerned neighbouring cantons and countries. Primarily, Members of the commission are representatives of the cantonal governments identified in Figure 3.2 The government of the canton Basel-Landschaft is an associate partner, as are the Swiss authorities SFOE and ENSI and the sectoral plan's Nuclear Waste Management Advisory Board. German authorities from federal, state and district levels also are represented, taking into account the proximity of four potential sites to the German territory.

Figure 3.2. Swiss cantons represented as full members of the Commission of Cantons



Presentation by M. Kägi, 7 September 2016

The commission makes recommendations to the SFOE regarding federal consultations concerning the Swiss site-selection procedure. To support this work, the commission set up an independent Cantonal Safety Working Group doubled by a Cantonal Expert Group on Safety, which both advise the Commission.

Switzerland is a small, densely populated federation. Among its special characteristics is direct democracy through the use of referenda. In completing its work of co-ordination the commission is highly aware of the dynamic between knowledge, societal acceptance and actual decisions. The commission contributes to the development of knowledge and confidence today. At issue is whether the full logic of today's decisions will be understandable by the citizens of 2050. The commission aims to win the positive assessment of future generations by acting as a guardian of the siting process, and ensuring a high degree of transparency, discussion and communication with all concerned or affected stakeholders today.

The regional conferences

In the late afternoon of the first day, workshop participants heard short presentations of the five regional conferences. As described above, each conference includes a management group as well as three workgroups, focused respectively on assessing surface facility proposals, socio-economic and environmental impacts ("SÖW"), and safety. Each regional conference is composed of representatives of municipalities, unaffiliated citizens, and members of local organisations (in varying proportions). Most participants are men, and their average age is in their 50's. The conferences include members up to or over 70 years of age, with a small number of members younger than 25 years old. In their presentations, the leaders of the regional conferences described the work and voiced the questions and concerns of their members, in particular regarding

how the knowledge built up within each conference can be preserved and transferred to the community, to persons less involved or who feel less concerned, and across generations.

Ueli Müller, co-president of the Regional Conference Jura Ost, described the challenge faced by the 96 members of the conference. Jura Ost is a site located in the foothills of the Aargau Jura mountains and underlain by Opalinus clay formations. It has been recommended by Nagra for more detailed assessment in Stage 3 of the siting process. Twenty communes of the Aargau Canton are involved in the participatory process. Local society as reflected in the structure of the conference includes representatives of authorities, wine growers, industry and commerce, unaffiliated citizens, youth, opposition and advocacy groups, nature protection and tourism organisations, political parties, and other pertinent associations. The conference and its working groups have held a total of 106 meetings since its establishment. Analysing the experience of the Jura Ost regional conference, Mr Müller emphasised the need for transparency as a condition for confidence building. He observed that local concerns grow but also evolve as knowledge is built up about various facets of the repository siting process. Conference members recognise that they have limited influence over decisions, yet they continue to actively debate issues such as those addressed by the workshop: how to reach sustainable, ethical decisions, delivering equity across regions but also across time.

Jürg Grau, president of the regional conference Zürich Nordost, noted that the siting region has been assessed most favourable (alongside Jura Ost) for detailed examination in Stage 3. The Zürich Nordost regional conference includes members from several cantons and from Germany. It covers the main agricultural region surrounding Zürich and important touristic sites including a Water Castle and the Rhine Falls, which receive more than 1.5 million domestic and foreign visitors per year. The conference counts 112 members and has held a total of 151 meetings. The conference posed several questions so far: If two or more sites fulfil the safety conditions of the government, what will be the role of criteria unrelated to safety – such as social and ecological considerations? Will specific Swiss structures (form of government, lobby of key players) impede or facilitate sustainable decision taking? To what extent should cost optimisation considerations prevail in choosing a socio-economic solution?

Hanspeter Lienhart, president of the regional conference Nördlich Lägern, with its 117 members. This conference has held a total of 121 meetings. Mr Lienhart recalled the difficult birth of the conference. Time spent up front to scrutinise the tasks, roles and rules was well spent, as it led to a very stable organisation which was rapidly able to commence its work and accept the federal-level experts. The process was disrupted at two points when overall transparency was questioned (following the leak of an internal Nagra memo), and when a German expert group questioned the conference's conclusions on the placement of the surface facilities, leading to the additional review. A specificity of Nördlich Lägern is the fact that in Stage 2 Nagra assessed the siting region as less favourable than Jura Ost and Zürich Nordost. Nagra proposed that Nördlich Lägern should not be further evaluated in Stage 3. However, the siting cantons requested to continue the evaluation of Nördlich Lägern in Stage 3 due to insufficient knowledge to exclude the site. ENSI also questioned the elimination and required additional documentation from Nagra.

Hans Fellmann introduced the Jura-Südfuss regional conference or platform of which he is the vice-president. Its specificity is to include and report to an association which establishes mutual legal obligations among all the municipalities concerned by siting in

the canton. The regional conference composed of 88 members can make proposals, but binding decisions are taken by the association. This is considered a factor of legitimacy. Local organisations and citizens participating in the conference are not legally bound. The platform views that the process of siting and implementing a safe procedure for long-term radioactive waste disposal is of great importance and must be continued. It has held 79 meetings, with the management group and the safety group being particularly active.

Project leader **Kurt Margadant** presented the Platform Wellenberg. A specific format was chosen for the regional conference in light of the local history of opposition to repository siting. This opposition dates back to referenda of 1988 and 1995, and came to a head in 2002 when the population of Nidwalden canton refused a permit for further geological investigations in view of a low- and intermediate-level waste installation. In part as a reaction to this popular resistance, the federal Nuclear Energy Act of 2005 curtailed the veto power of cantons or communes. Nidwalden's electorate rejected the principle of nuclear energy phase-out in 2010. In 2012, the Swiss Parliament rejected a cantonal initiative that would have restored the veto power of a siting canton by ruling that no deep geological repository could be sited against the will of the canton. The Wellenberg platform counts 30 members and has held 76 meetings since its foundation in 2011. In the process, platform members built up experience in co-operation and communication. The platform expects to learn from foreign guests at the workshop about how nuclear energy or repository siting discussions impacted their own regions, and what they felt they had gained.

The afternoon closed with a report on the doctoral research by political scientist **Claudia Alpiger** (University of Bern) evaluating the ongoing regional participation procedures. Her work seeks to fully document the process, draw lessons for other major federal projects, and show how to improve the participation of underrepresented groups. Fourteen criteria were grouped into four categories: process (fairness, transparency, early and iterative involvement, etc.), participation (balance of interests or of social strata, etc.), information resources, and effects (converting win-lose conflicts into win-win situations, etc.). The ex-post evaluation, using a total of 55 indicators, was carried out through documentary analysis, interviews and surveys. Recommendations were made on this basis and directed to the actors with the power to improve or make the process more effective. Exchanges between the regional conferences could be intensified, sharing the results of the working groups. Open events could be made more attractive to garner broader involvement of the general public. While diverse socio-economic categories are well represented in the regional conferences, efforts could be made to better integrate women, and immigrants (including those without voting rights). In particular, federal actors are urged to seek out greater participation of young people, whose generation will be faced by waste management decisions in the future. Overall, according to Ms Alpiger and the social science authors she cites, attention is needed to representing long-term and future interests to balance the expression of short-term interests.

4. The knowledge gap

David Brazier from the United Kingdom's Environment Agency and member of the FSC Core Group introduced the first of three topical sessions addressing the workshop theme of Bridging Gaps. This session focused on gaps in knowledge between experts and non-specialists as well as between persons alive today and future generations.

The preservation of records, knowledge and memory

Erik Setzman of Sweden's Nuclear Fuel and Waste Management Company (SKB) spoke about a special research endeavour of the NEA Radioactive Waste Management Committee. The Preservation of Records, Knowledge and Memory (RK&M) group has worked since 2011 to craft international, consensual guidance on how to fulfil the responsibility of current generations to inform future generations about sealed engineered facilities for the final disposal of radioactive waste. Twenty organisations from 13 countries are represented, including implementers, regulators, and national archives. Documents and proceedings from RK&M meetings are available on the NEA website.

A 'dual-track' philosophy has been developed by RK&M harnessing complementary tools and techniques to inform future generations, provide redundancy of messages, and maximise the survivability and understandability of communications. One track is the traditional, historical approach of passing on content from person to person and from one generation to another. The second track, which is also needed, addresses the future directly: producing messages that will persist and may be found and understood by persons in the distant future.

The RK&M group works with archaeologists and other scientists to understand how cultural heritage and messages from the past have reached us today, and get guidance on the right language and formats to ensure survivability of our own messages to the future. Among the useful mechanisms studied are: international legal documents, archiving, and marking the repository site (including by the emplacement of time capsules).

One instrument is the key information file (KIF), concentrating in 40-50 pages information about the existence, location and contents of an underground facility. The KIF will be important to future decision making about land use, and it should minimise the likelihood of unnecessary or inadvertent human disturbance of the repository. It should enable future generations to make their own competent and wise decisions about what to do with the facilities and their contents. The document specifies the dangers associated with the disposed waste, and summarises the data and thinking on which our generation bases its confidence in the long-term safety of the disposal system (the safety case). The KIF will be the most compact and non-technical record, widely distributed in many different types of archives internationally, in both print and electronic formats. It will point to other more detailed records about the repository, and where these can be found in permanent storage.

The KIF concept is tested in three present-day cases: the French Centre de la Manche (which is already closed), the operating Waste Isolation Pilot Plant (WIPP) in the United States, and the planned Swedish geological repository for spent fuel. After describing the chapter structure, Mr Setzman invited the assembly to reflect on what might be missing in the KIF, who should be responsible for preparing it, who are the anticipated users, and who should look after the KIF.

Local community knowledge building and transfer

Marie Berggren from the Municipality of Östhammar, Sweden focused mainly on near-term knowledge gaps. She is Head of the Strategy Unit which supports decision making about radioactive waste management but also other spatial planning and infrastructure issues with intergenerational impact. Ms Berggren emphasised that the municipality works each day to ensure the social welfare and development of the 21,729-person community, which enjoys a very high rate of employment in part due to the presence of nuclear industry.

Östhammar is involved in two processes, one centred on the existing facility for the disposal of low- and intermediate-level waste (which implementer SKB wishes to extend), the other centred on the potential future disposal of spent nuclear fuel. In 2016 national government confirmed the local power of veto over the possible extension of the L/ILW facility and accepted the principle of a local referendum on the spent fuel disposal project. After completion of steps involving other levels of authority, the final decision on whether to accept the deep repository project by Östhammar, and by the second community deeply involved in the disposal system, Oskarshamn, is expected in 2017.

Ms Berggren pointed to the most important features supporting Östhammar's more than 20-year engagement. Among these were: clearly defined roles for the implementer, the regulatory authorities, and the municipality; a voluntary process making it possible to step out at any time; financing from the national Nuclear Waste Fund. The municipality developed a set of statements framing their involvement: Long-term safety is the paramount issue; the community is an asset to the process and wants to be an active party from start to finish; conditions must be clearly stated before the municipality will take decisions or give permission; the community wants to understand the assessments, judgements and decisions of the authorities.

The municipality organised a reference group to develop knowledge and recommendations on long-term safety, environmental impact, health effects, and socio-economic aspects of the potential spent fuel repository. This group was recently extended to include neighbouring communities and non-governmental organisations which might intervene in a future referendum. Östhammar has developed present-day information materials and consulted the population. According to local surveys, residents want guarantees that only Swedish waste will be disposed of in their facility. They ask whether the repository will truly be closed and inaccessible one day or whether future generations might recover the spent fuel materials. They are also concerned about monitoring of repository performance, and how information will be transferred to the future.

According to Ms Berggren, the knowledge gap can be bridged by forming relationships between local decision makers, non-governmental organisations, and environmental and radiological protection authorities, and by raising critical questions with the mediation of an independent national expert organisation. As for information gaps across the generations, the municipality already had to interpret the 1980s decisions concerning

L/ILW. It is working now with SKB and many other actors including young people to develop the narrative of the repository to be communicated to the future. Believing that there is strength in numbers, Östhammar has bridged the 600-kilometre distance to Oskarshamn so as to share interests and perspectives, and also launched a European local Network of Radioactive Waste Dialogue (ENWD) within the Group of Municipalities with Nuclear Facilities (GMF).

Roundtable discussions on the knowledge gap

The participants broke out into small groups of 8-10 persons for discussions at round tables, grouping delegates from different countries and profiles with the Swiss stakeholders. The first roundtable discussion centred on bridging the knowledge gap in intergenerational decision making on radioactive waste management, in the specific perspective of deep geological disposal. A set of questions developed by the workshop hosts and the NEA was proposed for discussion, and the round tables chose the particular questions that interested them. A participant from each table gave feedback in plenum. The roundtable findings are summarised below, including recommendations for bridging knowledge gaps.

What is the difference between information and knowledge?

Participants started by clarifying the difference between information and knowledge. Information is an impersonal vehicle for telling, while knowledge (something personal, “inside your head”) is a vehicle for interpretation. According to participants, pure information is useless. Knowledge is required in order to read, understand, use and share information. Decision-making processes rely on a combination of information and knowledge, and for radioactive waste management this combination should be ensured both today and in the future.

Some participants pointed to “know-how” as a neglected but vital form of knowledge. Specific know-how required for radioactive waste management may be missing in future years, for instance if countries phase-out nuclear power generation. Participants noted that even today, nuclear engineering is not a popular field among students, and retiring professionals may be difficult to replace.

Maintaining knowledge

Knowledge on both the technical and societal aspects of waste management can be preserved by passing it along directly to new sets of individuals through education, training, and practice. It was recognised that non-governmental organisations can play an important role in the dissemination of informal education on the topic. Participants viewed that formal science education touching on radioactive waste management should be provided at primary, secondary and tertiary levels; however several obstacles must be addressed. School curricula may not foresee sufficient science and technology hours; balanced, attractive teaching materials may not exist (those provided by implementers might be viewed as one-sided); educators are lacking to train teachers in the topic. There is also a need to motivate future generations to maintain a lively interest in research on radioactive waste management and related subjects, and therefore to continue programming such education in the schools and universities. Participants remarked that overall, knowledge is not something that is passively acquired – this requires initiative, curiosity and questioning.

Knowledge must also be maintained as a cultural content shared among people. “Local legends” may be vehicles for knowledge preservation, but these may fade and be forgotten if people have little everyday contact with a repository, or if living with a repository ceases to be something unusual and people stop reflecting on it. An example was given from the Czech Republic, where only one in five residents is aware that low- and intermediate-level waste is stored in the familiar former mine. Roundtable participants suggested that after the Swiss sectoral plan siting process, a council of people from the region could be set up to keep the memory of the repository alive.

Participants felt that review documents are particularly useful for handing knowledge along. They suggested that organisations involved in waste management could adopt a culture of producing short narratives giving insight on how and why different steps were taken.

Saving information

Information for decision making on radioactive waste management can be saved through a variety of material and institutional means. Many suggestions were made as to the what, how and why of information preservation, referring sometimes to historical cases of information preserved over centuries, or irrevocably lost in catastrophes.

Round tables suggested the need to preserve information on the contents of the repository, its location, radiological aspects, and various technical characteristics, in the form of raw data and in the form of summaries or reviews. The Swiss regulator pointed out that the safety case will certainly be included in the information archived for the repository.

Participants called for safeguards against the risk of losing or not knowing how to read and interpret the information about the deep geological repository. This could be achieved by saving it simultaneously in several decentralised places (including neighbouring countries or at international level, since today’s political borders may shift in future). Chosen information should be saved also in different media, while not relying on digital formats because the mechanical readers evolve and become obsolete too fast. The information should be saved in a variety of different languages (including plain-language versions), and in non-verbal forms (pictures, figures, symbols).

At the same time, given that nuclear knowledge may disappear within 100-200 years, simple warning messages may be enough. The question was raised whether it is sufficient to preserve purely factual information, primarily concerning the location and possible risks of the repository, or should more detailed information be offered – including why our generation made its particular choices? Several justifications were found for keeping highly detailed records, but counter-arguments were found as well. Detailed records preserved for the repository could ensure future insight on precisely how and why today’s technical or political decisions were taken; yet these larger issues, like why nuclear power was used by our society, would be traced in many other archives independent of waste management (for instance, in historical records of the 2017 referendum on Swiss energy policy). Preserving the largest possible range of data or facts could support decisions that cannot be anticipated today; on the other hand, a surfeit of information could prevent future generations from zooming in on the needed content.

Overall, participants said that efforts should be concentrated on preserving key information for repository decision making. An issue is how to define what is “key” content, and who is invested with the responsibility to make this very important choice?

Formats to present and save the key information also should be selected by a legitimate authority. It was concluded that such vital decisions should be taken by a broad-based group including not only implementers but also representatives of many other – perhaps all – stakeholder categories, and that this group should not define the key information too narrowly.

Preserving knowledge and information in combination

Among the suggestions for maintaining knowledge and information in combination, one roundtable proposed that a residential centre be built on the surface over the geological repository, hosting educational and research facilities and housing the people tasked with these activities. Another proposal was to turn a decommissioned nuclear power plant into a memorial. Some participants warned that memory-keeping facilities should not be turned into tourist attractions (but the reasoning behind this was not stated).

Several round tables felt the state should establish legal guarantees that information and knowledge for radioactive waste management will be preserved, and define which stakeholders hold this responsibility. Local communities were seen to have a valuable potential for keeping information and helping to disseminate it, but some participants judged that memory keeping at local level is not sufficient, and that a nation-wide awareness on the issue must be maintained. Participants agreed that to keep knowledge and information about a repository “alive” over the generations a specific organisation is needed. This would ideally be multi-stakeholder, independent from the implementer, and possibly international.

According to one roundtable, society needs “the feeling that there is enough” knowledge. Because democratic decisions can be reversed, some participants pointed out that knowledge-keeping and financial commitments should be locked in and independent of subsequent political decisions.

Bridging knowledge gaps

Participants saw at least two knowledge gaps: between experts and non-experts; between involved and uninvolved people. Both gaps should be bridged in a radioactive waste management process. It may not be necessary to get everyone actively involved in decision making, but steps should be taken to facilitate people’s access to whatever information they need. For some participants, this means that awareness of how waste is actually managed in each country should be actively communicated. According to round tables, special attention should be paid to bridging gaps with young people and minority groups including women and migrants. This process may become easier when the actual siting of the repository is at hand and local people take an active interest.

It takes time to establish confidence. There have to be enough opportunities to exchange opinions among stakeholders and authorities. An example from Canada showed that when communities organise themselves to participate in decision-making processes, government or the implementer have to respect their rhythm and their concerns. Several participants suggested too that it will be increasingly important to listen to critical voices and to record mutual learning. Dialogues should include honest consideration of uncertainty and unknowns.

Some round tables indicated that bridging gaps would be most important during the operational phase of a repository (that is, the first 100 years or so). Others, however,

challenged the idea of keeping people aware and engaged throughout this period, because association with a repository could be detrimental to the region's image.

Recommendations

Roundtable participants offered the following recommendations for bridging the knowledge gap:

- The topic of radioactive waste management in particular, and (nuclear) power generation in general should be a mandatory part of school curricula. Passing on knowledge of both the technical and societal aspects can keep the political process going, and also contribute indirectly to skilled future management of unrelated challenges.
- Competence-building should include different world views. As many groups as possible should be involved because everyone holds “a piece of the puzzle”.
- The critical questions are very important, as well as stating sincerely what is not known.
- The preservation of practical know-how should not be neglected.
- Responsibilities as to which organisations maintain knowledge and/or preserve key information for radioactive waste management should be clearly defined.
- Review documents are useful. Organisations involved in waste management could adopt a culture of producing short narratives giving insight on how and why different steps were taken.
- Knowledge-keeping and financial commitments should be locked in and independent of reversible political decisions.

5. Sustainability of decisions

Lucie Steinerová of the Czech Republic Radioactive Waste Management Authority, member of the FSC Core Group, introduced the second topical session focused on ensuring the sustainability of decisions taken today and intended to last for generations.

The safety case as a decision-making tool

Lucy Bailey of Radioactive Waste Management, United Kingdom spoke as the Chair of the NEA's Integration Group for the Safety Case. She presented the role of the repository safety case in sustainable decision making. Ms Bailey defined a sustainable decision as one that maximises benefits to society, the environment and the economy. It is accepted by all stakeholders, endures over time and is fair to future generations. She suggested that sustainable decisions emerge from a transparent decision-making process empowering stakeholders to check the fairness, integrity and objectivity of decisions and how they are made. Decisions along the way to developing a repository will not endure if they are not based in clear, solid science. The progression from one decision to another must be clearly traced and the process must be open to taking in new data or understandings.

According to the NEA, a safety case is “a formal compilation of evidence, analyses and arguments that quantify and substantiate a claim that the repository will be safe”; it is “compiled and presented at certain stages of a stepwise repository development programme with an aim to inform decision makers whether adequate information is available so that decisions to proceed to the next step can be made”. The safety case is key to a range of necessary decisions, such as determining at the outset that a geological repository is feasible; replying to the question of whether a particular site is suitable; orienting ongoing scientific research and technical development; optimising repository design; judging the suitability of waste containers. The safety case provides the basis on which regulators ultimately licence a facility.

Ms Bailey spoke about communicating the safety case so that stakeholders among the public can use this tool as they participate in the decision-making process for a repository. She emphasised the need to use plain language and to build up trust between the technical specialists and the interested stakeholders to ease dialogue about the complex safety case information. The stakeholders should first be helped to gain understanding of the national regulatory framework for ensuring safety, and the basis on which it is possible to be confident in the regulatory process and the authorities' competence.

Ms Bailey next considered how decisions can be “banked” over a very long period despite the short cycle of changing political leadership. She showed examples in which planning authorities and legal instruments were created to carry over commitments, and said that safety regulations and regulatory authorities have an important role in maintaining long-term decisions and managing public expectations. Ms Bailey ended by illustrating how confidence in the repository disposal system and sustainable decisions

can be built up through an iterative development process delivering value for research money and ensuring that risks are as low as reasonably achievable.

Ethical reflections

Gaston Meskens from the Belgian Nuclear Research Centre and University of Ghent then spoke about ethics and the future generations. Dr Meskens explained that risk assessment is limited by uncertainty, while the justification of risky activities is limited by moral pluralism, or the fact that even if everyone has the same knowledge of risk, opinions on its acceptability can still legitimately differ. “Science can help us describe the options, but cannot help us make the choice.” He argued that societal choices about the public health risk due to technologies must be taken in “co-decision” and that it is a matter of social justice to enable a responsible and trustworthy co-decision process.

Dr Meskens then approached questions about present-day ethical duty towards future generations, how today’s society can be accountable to the future, and finding fairness and justice between the generations. He suggested that today’s decisions (including those relating to open or closed nuclear fuel cycles, or retrievable or non-retrievable disposal of waste) inevitably reduce the ability for self-determination by future generations and impose today’s moral vision on the future. In this view, responsibility towards future generations is to seek sustainable development (preserving resources for the future) but especially, fairness in the actual decision-making processes. According to Dr Meskens today’s society should ensure that today’s decisions can be explained with peace of mind as “the best we could do”, and for this, preserve records of present-day dialogues.

Dr Meskens criticised the workings of representative democracy as producing polarisation rather than conciliation, and pinpointed factors that reduce the quality, objectivity and independence of scientific inquiry. He suggested that generating societal trust in the governance of radioactive waste management cannot be achieved without opening up the scientific process and employing participatory democracy to integrate natural and social sciences and humanities, informed civil society, and potentially affected persons. He particularly urged that children be educated about the complexity of societal problems such as energy governance, enabling them to develop critical minds, self-reflexivity and an ethical sense.

Dr Meskens ended with the view that the search for radioactive waste disposal solutions should not be driven by the motivation to “prove” that nuclear energy is an acceptable energy technology option. Remarking that the options of “waiting” and of retrievability are not explored yet in all their conceptual, ethical and practical meanings, he suggested that lifting time pressure and adding flexibility can contribute to taking good decisions. In response to questions, Dr Meskens highlighted that community veto power is not a “wild card” but instead, a feature that allows participants to take decision making more seriously.

Political science reflections

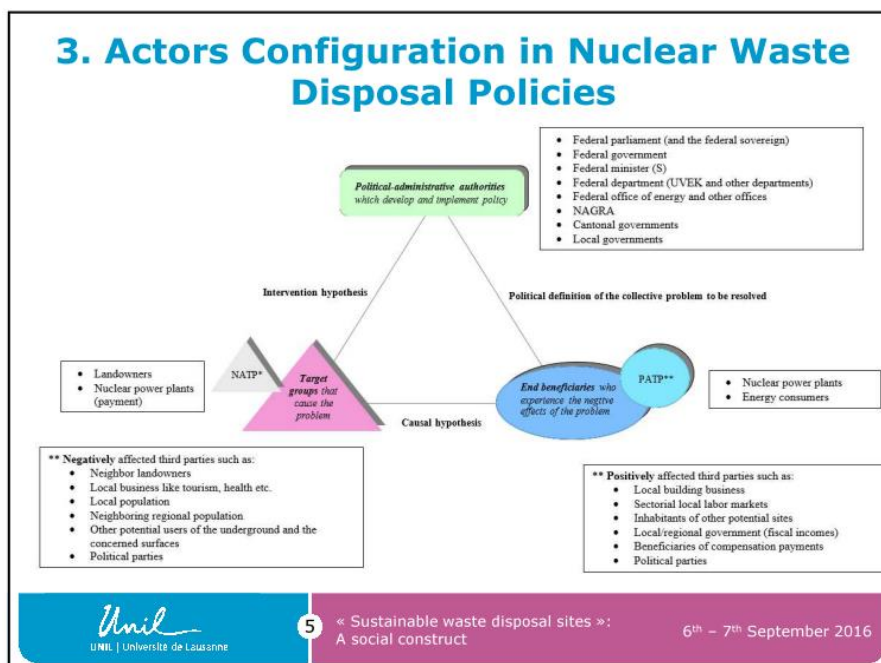
Peter Knoepfel of the University of Lausanne then spoke about the configuration of actors in national nuclear waste disposal siting policy. He said that sustainable decisions are products of social engineering processes which fairly seek to secure consensus among the directly and indirectly involved actors. For a peaceful and sustainable solution of the waste issue, there must be the best technological safety standards, and nation-wide political support combined with local/regional consensus: one level cannot impose its will

upon the other. Professor Knoepfel reviewed the basic features of procedures that allow fair exchange of actors' resources, including power, law, money, information, time and landuse rights among others: "I give you consensus, you give me compensation; I give you law, you give me political support".

Professor Knoepfel then focused on the constellation of actors, claiming that their configuration is often more complex than supposed. Deficient analysis, he said, is a frequent reason for the failure of waste management policies which are thereby exposed to unexpected opposition or to challenge by newcomers. He showed what he called a quasi-universal model of actors' configuration in public policy (Figure 3.1). Three poles are present: political administrative authorities who develop and implement policy; end beneficiaries who experience the negative effects of the problem to be solved by the policy; target groups that cause the problem. The diagram "mapped" the particular actors involved in the present Swiss case at federal, regional and local level.

Professor Knoepfel advised that unexpected positioning and "hidden" actors should be revealed. In order to minimise distrust, double or triple positioning by a single actor should be avoided. The target group (which causes the problem) should not be the end beneficiary. The professor urged special attention to the negatively and positively affected third parties associated respectively with the target and beneficiary poles. He described these as key players, who however are not directly involved in the siting procedure. These groups should be taken seriously and the solution should bring positive consequences to the negatively affected groups. Compensation is one tool for this, and it should be determined by an objective cost/benefit analysis combining not only physical damages but also lost opportunities or revenues.

Figure 5.1. Actors configuration in nuclear waste disposal policies



Presentation by P. Knoepfel, 8 September 2016

Finally Professor Knoepfel reflected that there is little need to rush to take decisions. An institution should be tasked with monitoring the situation as it evolves, so that decisions can be set when their potential consequences are better known. He called for flexibility in the procedure for this reason.

In the ensuing discussion, Gaston Meskens agreed that time to understand future impacts is needed. He suggested that new facilities generally cause less burden than the older ones inherited by future generations. Sustainable compensation, he said, should therefore come in the form of local development or added value for the community, rather than being calculated to offset present-day nuisances such as the number of trucks that may drive through during repository construction.

Roundtable discussions on sustainability of decisions

The second period for roundtable discussions was conducted in newly formed groups mixing persons who had not sat together in the previous session. They discussed policies and practices for making sustainable and fair decisions about radioactive waste management, and gave some recommendations.

Judging decisions over time

The round tables largely recognised that decisions have to be understood in the context of when they were made. Today's generation lives with past decisions, good and bad, and many that were taken without popular consent (such as the choice to generate electricity using nuclear technology). Decisions are often taken with incomplete information and will be judged in the light of later consequences. For instance, asbestos was widely applied in buildings as fireproof insulation at a time when its health risks were simply not known.

Some participants pointed out that intergenerational justice is about finding a balance between possibly negative impacts and progress. They said that although there is a tendency to focus on risk and negative effects, these are not the only consequences of decisions taken today. Today's generation should seek to produce benefits for the future, and technological development often does deliver better health and safety. Good decision making will look at constraints and impacts across the whole system; for instance, the topic of managing radioactivity cannot be looked upon in isolation from energy policies.

Participants pointed out that there is not always a clearly right decision, and all policy decisions will not be acceptable to everyone. Today's responsibility is to act in light of the best information that can be assembled. Participants said that today's deciders should try to make choices that appear the best and the most acceptable to the greatest number, and communicate the reasons for these decisions so that they can be understood later.

One roundtable suggested that societal contexts produce their own inertia which affects decision making. When a society has reached a certain level of wealth it may be too comfortable to question its own assumptions. Some participants thought however that the resistance to change affects mainly the older generation. Younger people may be more open and less convinced by "business as usual". They may have different concerns and values. For instance, a youth representative at the workshop suggested that current consumption habits will not last long and that future society might live in greater

harmony with nature. Some called for a critical attitude and awareness of how mindset affects the sustainability of decisions. An example was given from before 1980. At that time only men were empowered to vote in Switzerland, a situation unimaginable now and which produced decisions that cannot be entirely sustainable because they potentially left aside the views of half of society.

Given that there will always be changes in knowledge and in circumstances, roundtable participants felt that future generations should be afforded the opportunity to manage their situation and make adaptations. Today's decisions should leave room for flexibility in their implementation. For instance, Nagra must propose a performance monitoring system for the repository, which ENSI will assess, but the period of time over which the monitoring must be conducted is not firmly set today.

Good process

Participants recognised that knowledge, political, social and legislative contingencies can change and cannot be entirely foreseen when beginning a major endeavour; for example, Nagra needed to enlarge the planning areas for surface facilities. The round tables agreed that changes will be better accommodated when the decision-making process itself is predictable, transparent and fair. Without a clear stepwise process, they said, decisions are not sustainable even in the short term. In this way “sustainability starts with process design”. Many agreed that the actual sustainability of a decision may be more tightly linked to the manner of deciding than to the precise decision outcome.

In this light the long time frame of radioactive waste management decisions was seen as positive, giving sufficient time and flexibility to deliberate and continuously improve the process. Round tables pointed out that while the Swiss process is taking years longer than initially planned, this is common in repository siting. In a multi-year stepwise decision-making process some steps may need to be reconsidered and adjusted, some within months and others within a period of perhaps 50 years.

The round tables outlined desirable features of participatory decision making. Some said that it requires honesty and authenticity: all stakeholders should transparently state their intentions, roles and ability to influence the process. The rules governing the process must be established and known to all actors before the start. Other important factors are the possibility to freely voice opinions before the decision is taken, and that people feel that their input is heard.

Positive features of the Swiss site-selection procedure were brought forward. A young participant praised the fact that not just one authority, but a diverse group of stakeholders is taking decisions. Some approved the fact that politicians are “out”. Others observed that the regional conferences bring the issues to the region and there is practical, not theoretical participation. Even if the conference members are empowered only to give recommendations, the process is still influenced in this way by local views.

Round tables viewed that economic compensation for host regions should not be a show-stopper. Adequate compensation should surely be part of the solution. It was recognised, however, that the suspicion of “bought” acceptance can arise rapidly, and so a fair process should guard against this.

Political systems

The round tables discussed representative, participative and direct democracy. They pointed out that majority decisions are not always fair and may be influenced by lobbies or by populist ideas. Each country has its own political system for including minority views, or not, in policy decisions. Different country examples were discussed, such as when in the United Kingdom, a regional government rejected a repository siting step that had been prepared and willingly accepted by local governments. Some participant asked whether for a very long-term project like this it is fair to rely on the habitual voting procedures reflecting today's territorial units. It was pointed out that in the far future these administrative borders may no longer mean anything.

In Switzerland, while the cantons and municipalities do not have veto power in the federal site-selection process, the general electorate will have the opportunity to vote on repository licensing, which is not the case in other countries. Some participants questioned the actual meaning of a public referendum on a technical licence. They suspected that this would not be a targeted decision based on the safety case, but an emotional assessment of negative images associated with a waste repository. The participants saw the optional referendum as potentially a process-stopper and asked whether there is a "plan B" in case a licence granted by the Swiss Parliament is rejected by the popular vote.

Roundtable participants reflected that decision-making processes should be designed to withstand political change. Some viewed that the multi-year Swiss sectoral plan procedure is not easy to overthrow because each stage will be decided by members of a different government. It was observed that in many countries elected officials want to avoid the topic of radioactive waste management and build their career on other more popular issues. The regulatory authorities contribute more to process continuity and sustainability. Once policy orientations or decisions in principle are set in one political cycle, the stable institutions have the basis to apply them and move forward.

In Sweden, the municipalities decided to engage with repository siting considerations 40 years ago trusting that legislative frames would survive and support a fair process and ongoing local participation.

A fair and sustainable decision on managing radioactive waste

The round tables discussed ethical duties. Ethics as well as law forbid the shipment of radioactive waste to developing countries; it must be managed by those who produced it.

Some stated that to be fair to future generations the present generation needs to look for and implement the best presently achievable safe disposal system including a retrievability option, and for which no further maintenance is needed post-closure. It was recognised also, however, that after a given point waste retrieval becomes an extreme technical and economic challenge. This highlights the observation that the round tables mainly discussed the societal pillar of sustainability without considering the economic and environmental pillars, which could conceivably be opposed.

"Reversibility is a key item for decisions and a criterion of good governance." It was pointed out that succeeding generations still have decision power because there will be plenty of time to adjust and rethink before sealing a repository. The Swiss stepwise process was praised; each progressively more specific licensing decision provides a checkpoint when new knowledge and other present contingencies can be assessed.

Along the decades-long time frame of repository development, a balance has to be found between criteria which evolve in different directions. For instance, there might be a temptation to push storage into the future because the technology for waste management might improve over the coming years; however, at the same time, waste that remains outside a repository is exposed to e.g. terrorist threat.

Risk and safety communication

Participants pointed out that there is a need to communicate the following message: while absolute safety is not possible, everything will be done to achieve safety in the waste management system. Today scientists are asked to tell society if the site and system are safe, to explain and to keep a record of how they came to that conclusion. Participants suggested that scientists and technicians need to learn to communicate about risk, presenting the full range of possible events that could hinder safety. There will be more societal confidence in their messages if experts are clearly independent of economic interests.

One roundtable suggested that involving non-specialists as well as expert stakeholders in discussing and interpreting the safety case may enhance its quality over time. While safety is recognised as a priority by all Swiss stakeholders, it was pointed out that the safety case could take into account potentially different perceptions of risk and definitions of safety by different sectors of the public.

Recommendations

- To be fair towards future generations, the present generation has to look for a solution to the nuclear waste problem now. This solution has to be the best presently achievable solution and needs to include the option of retrievability.
- The solution has to aim for long-term positive effects and find an intergenerational balance between benefits and burdens.
- Reversibility is a key item for decisions and a criterion of good governance.
- A well-designed, clear and transparent process is very important to explaining the outcome later on.
- The process has to be flexible but also sufficiently robust to withstand rapid political change or populist movements.
- Debate and dialogue are crucial. All stakeholder groups should be involved and a continuing effort must be made to include the groups that are underrepresented in the process.
- Stakeholders must be transparent about their motives, means and role in the process.
- The safety case should contain not only calculations but also a set of arguments and a stepwise process to answer fundamental questions.
- Uncertainties should be defined and communicated openly. A site should be presented as corresponding to what scientists consider to be safe (rather than as “a safe site”).

6. Intergenerational knowledge gap and sustainability of decisions

Christine Pineda of the United States Nuclear Regulatory Commission and member of the FSC Core Group introduced the final topical session building on the work of the past two days. It focused on the intergenerational knowledge gap and how this relates to ensuring that decisions are sustainable.

Challenges of involving young people

Michelle Beyeler, Bern University of Applied Sciences, and **Nico van der Heiden**, Swiss Association of Young Doctors, spoke about involving young people in radioactive waste management. Professor Beyeler and colleagues performed a survey of 17-year old Swiss residents for the Federal Commission for Child and Youth Affairs in 2015. The results showed that young people in Switzerland ascribe less and less importance to voluntarism and political engagement. They find family and life partnership, work, education and leisure all much more compelling. If the young people participate in political debate or action at all, it is most often through the Internet. Professor Beyeler relayed that the young residents have not yet developed strong political positions. Overall they resemble their elders, tending to the political middle ground and trusting the authorities. (During the question and answer period, Professor Beyeler observed that 40-50% of the electorate typically do not turn out for the frequent referenda of Swiss political life.)

The Eurobarometer studies of 2008 and 2013 indicate that while knowledge about radioactive waste management is dropping in the general population, knowledge of and support for the repository solution are found together and are more common among older Swiss residents. Professor Beyeler pointed out that generally people living in the most involved regions describe themselves as sufficiently or very well informed about radioactive waste, whereas this drops off with distance from the region. Young people as a group show much less awareness. She concluded that it is very important to actively involve and inform young people if their support for geological disposal is wanted.

Dr Van der Heiden offered simple hands-on ideas for improving the involvement of young people in local deliberations. First he advised that organisers lower their expectations because at both national and local level, participants in political decision making are typically older men. Five per cent representation would be realistic. The topic of deliberation should be interesting and widely advertised with a title focused on young people's natural concerns rather than obscure technical issues. Marketing materials should target young people and outreach should be performed directly in the places they gather or by creating a Facebook event. Compensation should be offered for attendance, and the requested commitment should be short accepting that there will be dropouts because young people must move around and prioritise their education and entry into working life. While the deliberation process overall requires years, it can be broken up into modules and young people solicited for a specific, 3-4 month procedure. The setting

should not be highly formal or institutionalised. Finally, the discussion must be non-ideological, perhaps inviting young people to forget about environmental politics for a time and focus on pragmatics. The process must be open, without foregone outcomes, so that the participants can build up ideas and meaningful contributions. The right to speak must be fairly guaranteed, whether or not a participant holds a majority opinion, and young people should be encouraged and told that “there are no stupid questions”.

Roundtable discussions on the intergenerational gap

A new set of round tables broke out to discuss how the gap between generations today should be addressed in order to produce sustainable decisions on radioactive waste management. All recognised that young people and the upcoming generations should be included in today’s radioactive waste management decisions and planning, since they will take over responsibility for implementation and operations.

The need to act now

The round tables recognised the intergenerational dilemma: failure to act now to manage radioactive waste will leave a burden on the next generation, but actions now may render a better future solution impossible. Even an absence of decision has consequences.

Pensions and climate changes are intergenerational issues as well, but with shorter time frames. Either way, we leave something to the next generation. It may conceivably be cleverer than ours. However, according to some participants it is better to plan conservatively. Now, we have the money, the knowledge and the competence to manage waste. These can easily be lost. This is a risk and a reason to act now.

Perception and communication issues

The round tables analysed various perception and communication issues. Among these is the particular nature of radioactive waste management. It requires infrastructure, which like any other shared equipment and land use costs something, affects different interests, and demands trade-offs. However, repositories are not directly comparable to typical infrastructure. A road for example can be an asset for the whole community, whereas advantages linked to a repository don’t stand out. Roads exist and are a functional solution, which is not clear yet for the repository. It is possible to undo a road construction; waste is retrievable, but at a much higher cost and effort. It may take years to generate and study versions of road projects and come to agreement, but for a nuclear waste facility there is an added dimension of thousands of years to be considered.

Several studies show that residents of the Swiss siting regions don’t know about the siting process. People have to attend to many everyday matters. There are many other problems in our society; radioactive waste is only one of them. Because the possible waste facility is still far away in time, people care even less.

Content and medium, but also the identity of the sender – and recipient’s experience with and trust in the sender – all influence how information is received. Science generally has a high degree of credibility in Switzerland. In some national contexts people trust NGOs the most, ahead of science or government. Roundtable participants viewed that a diversity of sources on a topic (implementer, regulator, authorities, NGOs) can lead to increased reliability of information through cross-checking, and all these sources should be involved in communicating about the repository programme.

Barriers to involving young people in particular

The roundtable discussions found that young people are concerned about the future and leaving the earth a better place. They are informed about climate change, motivated to limit it, and feel they can make a difference through their daily transport and consumer behaviour. These clear connections are missing in the case of nuclear waste management. The younger workshop participants said of the regional conferences that they don't feel they can change anything by "sitting in a room and talking about a problem". More generally, the young Swiss attendees said that they often feel powerless. They have no vote in referenda. They are discouraged too by their experience with youth parliament where no action is taken on their proposals.

At several round tables more barriers to young people's participation were identified. It emerged that during regional conference discussions the young people don't want to interrupt older speakers or be embarrassed if their comments are seen as naïve. Addressing complex socio-technical and scientific repository issues requires a real commitment of time, focus and learning; for young citizens, who are setting out in life and don't know where they will be in 1-2 years' time, this commitment is even more significant.

Round tables concluded that youth may need a special format and empowerment in order to contribute to the siting process. There should be explicit rules to level the hierarchy between old and young, and encourage and ensure respect for young people's input. Importantly, the young people need to see action taken on their suggestions, and to measure the impact of their participation on actual decisions.

How to involve and engage youth

The discussions considered many angles of how to involve and engage youth.

To raise specific awareness, round tables reflected that this can happen if radioactive waste management themes are mentioned throughout society in books, media and schooling. Such conversation could consider infrastructure with intergenerational territorial impact, as for example roads, railways, or shopping malls; from there, it is possible to move on to specific radioactive waste issues. Some proposed that these topics should be part of school curricula from about age 16 but only if students have the chance to develop their own opinion, using independent information. Workshop attendees suggested that the safety regulator can take an active role in communicating and providing information about safety in understandable and attractive forms, like video.

Concerning the approach to scientific content, round tables considered that motivating young people to engage in scientific thinking can be difficult, especially as fewer enrol now in science studies. A good rule is KISS (keep it short and simple): information has to be broken down to a manageable level in accessible language while keeping it true, believable and honest, and without oversimplifying. Risks should not be hidden from the public. Young people could perhaps be particularly interested in addressing the open questions on the topic.

Several models exist for engaging debate and deliberation in schools and could be adapted to the radioactive waste management area. Oxford-style debates are organised in Poland on societal topics. These imply one week of team preparation, formal arguments, and audience selection of the best team. Debates can be organised between schools. This was done in Sweden when preparing for the referendum on nuclear power in the 80s.

Today in Sweden, school children can freely choose to deepen one topic every Friday. Even if radioactive waste is just listed among potential topics, this will help to raise awareness.

Participants pointed out that adults are role models and should bring forward the culture of discussion and engagement. They should be careful not to oversimplify, and to explain that this is even more than just waste. “We should tell youth not only what but also why”.

Concerning diverse means to contact and engage young participants in waste facility siting procedures, networking was key to recruiting young people for the Swiss conferences. For broader outreach, attendees recommended using diverse channels and taking account of the fact that young people use social (not traditional) media. Because young people have plenty of other options and interests, information on radioactive waste management, and the siting activity itself have to be made really attractive to get attention or commitment. Influencers and famous people can act as magnets (the chance to meet Federal Councillor D. Leutard brought some young participants to Bern). Engaged youth themselves subsequently act as multipliers. Participating in the FSC workshop raised the interest of young people for the topic and this can be leveraged.

The idea of organising distinct regional conferences for youth was suggested by several round tables. The young people want to discuss in their own subgroup, without observers or monitors. There could be some experts to help uptake technical information but the atmosphere and proceedings should be simple. The youth conference would then be empowered to present conclusions in regional plenary. This would demonstrate respect for their contributions, which is very important for the young participants, and help to take the input duly into account.

To facilitate commitment, the siting procedure and thematic discussions could be split into small packages implying participation for just months or a year. Financial compensation too is enabling for young people. A neutral fund to allocate monies would remediate any appearance of being “bought”.

Several round tables recommended that the repository debate should not be made ideological. Some young attendees pointed out that they want to know the whole picture, rather than sit in conference with activists who only want to communicate their opinion, not discuss the subject matter. In Switzerland, many elders have a long history of opposition to or support for nuclear energy. Young people have no such historical “baggage” and are free to approach the topic differently and reach their own conclusions. They have grown up with nuclear energy which is perceived as a part of their life.

Recommendations

- Current knowledge and resources and the strength of running research efforts should not be underestimated. It cannot simply be hoped that future generations will be more clever. Plan the pessimistic way.
- Discuss environmental issues in general (e.g. global warming) in schools. Multiply the connections by including such issues, including radioactive waste management, in cultural products for children.
- Short-lived information channels such as Twitter and Facebook may not be the place to take sustainable decisions. However they may be used in a first step to engage young people in the process.

- Involve influencers, famous people whom it is interesting for the young people to meet. Engage young people themselves in communication and let them act as multipliers.
- Access to information should be easy and connected with young people's concerns and activities, for instance through an event such as a party or a concert. However, who should sponsor these events is an issue in itself.
- Methods of participation must be adapted to young people. They have other priorities and things to do in the evening! Create participation forms exclusively for younger people.
- Describe how the subject matter will affect them ("what does it have to do with me").
- Allow young people to work out ideas for themselves and find their own solutions.
- Communicators must have an easy contact with young people.
- Take the emotional connection to an issue into account to motivate interest; provide not only information, but also entertainment.
- Give due account to the opinions and inputs of young people. They need to see that their participation is meaningful and impactful.

7. Feedback from workshop constituencies

Jo-Ann Facella introduced the final session of feedback. The young people, local Swiss participants, and FSC delegates from abroad had broken out respectively into three groups to discuss what was learnt, what could be improved, and which topics would benefit from further attention. Spokespersons from each constituency relayed the feedback.

Michael Rogenmoser and **Itamar Piller** shared feedback from the youth who attended the workshop. They all enjoyed meeting and discussing with the diverse attendees from Switzerland and abroad. They learnt a lot about how the repository site-selection procedure works and how their participation could be of value. It was gratifying for them to be the focus of attention at the round tables and to observe that their opinions were listened to.

Workshop presentations were assessed as generally long and dry and in future could profitably be modelled on TEDx speeches (using more imagery and storytelling). Dr Van der Heiden's "7 points" for involving youth were well received – especially as the youth delegation had come to essentially the same ideas in their own previous conversation. The young attendees were sorry that they had not been asked to make a podium presentation.

The spokespersons highlighted that the young people at the workshop were "more than simply young". They came from different regions and disciplinary backgrounds. They realised that they could participate in the radioactive waste management process as citizens but also as future engineers or political scientists.

The young participants said that there is a lot of information available but it is not sufficiently accessible and concise. Not only young students but surely older persons as well would appreciate being able to understand what is currently written only in technical reports. They gained a view into political process and realised that everyone can contribute something to the debate. They requested insight into what would be done with their input and whether there would be further opportunities to be involved. They suggested that a youth regional conference could be established, so that younger residents can inform themselves, take action, and spread knowledge to their school or peer communities. This possibility for young people to engage in the discussions and decisions should be proposed as a facet of the right to vote.

Petra Baumberger, Member of Switzerland's Nuclear Waste Management Advisory Board, delivered feedback from participants representing the regional conferences, cantons and German communities. These local participants felt that there was not enough information provided on the models, procedures and approaches used in other countries. They would have found it useful to learn about the topics of concern and the solutions that emerged from public participation, and to know where each country stands in radioactive waste repository development. This could be achieved through a short presentation at the start of the workshop.

The local participants appreciated the openness of the visiting workshop attendees and their tolerance for differing opinions. They were happy to make international contacts, mainly during the coffee breaks. The discussions were found to be very rich and the workshop days more valuable than anticipated by many. They regretted that there was not enough time to deepen the discussion on important questions such as fairly developing sustainable decisions or finding ways to involve young people. The workshop itself did a good job of integrating young people and much was learnt from these participants.

The spokesperson said that local participants would have preferred to leave the workshop with concrete outcomes, such as joint recommendations for follow up in the regions. They hoped that the process especially of reaching out to youth and getting their actual input would not end with the workshop, and that the good ideas exchanged in the workshop would become binding resolutions. Future topics of value would be: how to keep today's young people on board so that they can understand, accept and carry on the decisions that will be taken; making sure that all that was learnt about fairness, transparency, and the involvement of minorities (not only youth) can be transferred into the Swiss sectoral plan practices. How to transfer knowledge to future generations remains a major concern for the local participants.

8. Closure of the workshop

Ulrich Smeddinck, assistant professor of law Technical University Braunschweig (Germany) gave a report on findings and impressions of the 10th National Forum on Stakeholder Confidence (FSC) Workshop.

Observations by the independent rapporteur

“Over the past three years, I’ve been involved with nuclear waste as part of ENTRIA (Disposal Options for Radioactive Residues: Interdisciplinary Analyses and Development of Evaluation Principles), a joint interdisciplinary research project sponsored by the German Federal Ministry of Education and Research.

“I would like to take this opportunity to comment on a few points which I found particularly interesting. Introducing the workshop, Doris Leuthard, Member of the Swiss Federal Council, said: “We can do this!” NEA Director-General William Magwood also said: “The workshop is a great opportunity to discuss technical issues.” They set a positive tone from the outset. But what point am I making?

“Germany is increasingly becoming an “anti” society, where change of any kind is rejected as a matter of course. I’m not just talking about major infrastructure projects either. Local residents in Braunschweig even protested about a residential care home development.

“We need a “Pro Repository” movement as described by colleagues from ENTRIA in an article on this subject. It’s not enough to have a legal obligation – society needs to pull together on this.

“Let me give you another quote from the opening presentations. Roman Mayer from the Swiss Federal Office of Energy (SFOE) made the following point: “Technology and safety are not up for discussion.” I found this quite surprising. This event also touched on the dilemma facing experts – it’s one constant round of opinions and counter-opinions. And yet, we need to ensure transparency in this field – and we need to stick to our guns.

“Let me tell you about one moment I experienced during my work with ENTRIA. One meeting took the form of a debate. My colleague Professor Harald Budelmann, engineer and materials scientist, soon to retire, was speaking in favour of disposal in deep geological formations with the option to retrieve waste. He ended with the words: “I just don’t know!” There was silence. Enough to send shivers down your spine... But why?

“It’s certainly unusual for an experienced scientist to conclude his expert statement with such a comment.

“We need to be honest with ourselves. Admittedly, a million years represents a great deal of uncertainty and conjecture, but conveying this creates confidence! No matter what we do, the problem of nuclear waste will not go away. People are only too aware of this, but they are no longer prepared to have the wool pulled over their eyes.

“We often use important-sounding words like confidence, transparency, fairness, acceptance, and yes, these are major values... or are they just empty concepts? The truth will out in practice.

“This morning Professor Beyeler told us about how young people tend to trust the authorities. One aspect of a transparent system, and perhaps also of the growing-up process, is the realisation that the authorities don’t just represent the common good or that there is only one right answer to a given question.

“Authorities operate on a hierarchical basis. They have a “caste mentality”. They are susceptible to political influences. Budget pressures may come into play. There are career expectations to be considered. All aspects to be grappled with at high level.

“So keep your wits about you: scepticism and a healthy dose of mistrust are (sadly) very much the order of the day!

“In Germany, confidence is an “out” word. This is down to Gorleben and extremely polarised debates on this subject – for historical reasons, of course. Tu felix helvetia! Or in plain English, lucky Switzerland – at least that’s one problem you won’t have to face – not yet at any rate! But even here, the case of Wellenberg shows how quickly confidence can be destroyed.

“Dialogue: we have heard that one-way communication is a no-go. The applicable German laws use the phrase “dialogue-oriented participation”. But what does this mean? Martin Buber, a German theologian, who has studied the notion of dialogue in some depth, defines it as follows: “Dialogue isn’t simply the ability to question oneself, but also a readiness to change your own perceptions as part of the dialogue.” If we take that as our goal, how should it be interpreted by staff in the authorities? We have Jürgen Habermas to thank for reminding us that concentrating too much on enforcement can break down participation.

“Let me go on to some observations from the round tables on the ways and means of implementing proposals. Even in the early rounds of talks I came across a moderator who questioned his role, and another moderator who expressed the results she had observed in very precise terms within the group. Everyone present was quite content. Both are examples for good practice.

“The quality of public participation is anything but a trivial matter. At events organised by the German Repository Commission, I have come across public relations agencies that were not very good at their job. If badly done, this can destroy ongoing confidence and thwart expectations.

“Here, in this workshop, the NEA has created a good framework for the exchange of ideas: we have seen serious, engaged and lively discussions, led by provocative, responsible people with a wealth of ideas at their fingertips. Utopian thinking was certainly encouraged at times! We also shared some funny moments and drafted statements based on our own individual experiences. Above all, we listened, one of the most important aspects of an effective communication strategy. And 70 minutes of discussion has to be better than just one hour, especially as experience shows, time and time again, that 60 minutes just isn’t long enough.

“Emotions do come into play where the safety case is concerned – as I found out personally. In my opinion, this is a huge step forward. There is nothing to be gained by leaving emotion out of the equation. Emotions should be recognised as having a rationale

all of their own. They should be given due and serious consideration. Admittedly, this may be quite a challenge for engineers and technocrats...

“On the subject of young people: Thea Dorn, a German author, recently published a novel in which the main character was born in the 18th century – and is still alive today. A work of fiction, of course. Given our life expectancy, the problem is increasingly for future generations: which is precisely why the workshop focused on the transfer of knowledge to future generations and the need to recruit younger people.

“There’s no denying that nuclear waste isn’t sexy. Young people have always been fascinated by philosophy and history, but the benefits of difficult subjects do not capture the imagination in quite the same way. And yet, the discussion about waste repositories surely has some sort of science fiction appeal, despite the fact that the problem is only too real. It is entirely right that we should make huge efforts to get young people on board. Notwithstanding the fact that almost all political spheres, even those dealing with the most weighty and fundamental issues, only ever reach a fraction of the public! Following on from Dr Van der Heiden this morning: we need to lower our expectations in this area.

“But then again, diversification is essential. Single-minded groups are a dangerous prospect!

“One striking example is where technocratic technocrats from the worlds of politics, industry, science and the authorities have undermined the waste repository project in Germany by failing to connect with society or to convince the public about their work.

“A range of different opinions and views, international information exchanges – such as this workshop –, the involvement of men and women, the old and the young, native inhabitants and immigrants is the very best form of self-regulation and protects us from reaching the wrong conclusions.

“Finally, I should like to return to this workshop’s motto and refer once again to the deep gulf between informed and engaged citizens and those who have spoken to us at this event and incited us to action: Each and every individual dealing with nuclear waste issues should regard themselves as a bridge builder and act accordingly!

“This may mean contributions at micro level, but every little bit will help to smooth the path towards a repository for nuclear waste.”

Closing remarks

Stefan Jordi, gave closing remarks on behalf of the Swiss Federal Office of Energy (SFOE). Mr Jordi spoke about how integral the timing of this workshop is in inviting international guests to discuss the various stages of the Swiss process for finding deep geological repositories. It was decided, that “the middle” of the process might be the most beneficial time in order to reflect upon the experiences, thus the SFOE hosted this FSC national workshop at this time. He also acknowledged the benefit of international experiences as learning opportunities when developing strategies to address radioactive waste management. Mr Jordi expressed how worthwhile the workshop was for discussing ideas and themes to develop actions for the future. He also listed the eight points that were crucial for site-selection process:

1. Clear definition of roles/continuity in those definitions and roles
2. Common definition of the procedure with
3. Flexibility

4. One size does not fit all
5. Dealing with uncertainty
6. Consideration of today's decisions on future generations -intergenerational fairness
7. Explanation and validation of decisions and why they were
8. Involvement of youth in current processes and developments

Mr Jordi expressed his appreciation of the NEA secretariat, FSC bureau members, the programme committee, the members of regional conferences and cantonal representatives, Nagra, the interpreters, Jo-Ann Facella, and Pascale Kuenzi.

Final words from the NEA Secretariat

Yeonhee Hah, Head of the NEA Human Aspects of Nuclear Safety Division, closed the workshop as representative of the NEA Secretariat of the Forum on Stakeholder Confidence. She thanked the Swiss Federal Office of Energy (SFOE) for hosting and organising the 10th National Forum on Stakeholder Confidence Workshop. She acknowledged the contributions to the organisation made also by the FSC delegates. Ms Hah shared her belief that stakeholder involvement in decision making is important in all nuclear sectors, and announced the NEA workshop on this cross-cutting topic (Paris, 17-18 January 2017). She noted that Pascale Kuenzi, the newly elected Chair of the FSC and Regional Participation Specialist at the SFOE, would speak there on behalf of the FSC and the national workshop. In this way the Swiss stakeholder views would be presented to specialists from across the globe and would help them learn about improving involvement for better-informed decision making.

Yeonhee Hah recalled the proverb: *to go fast, go alone; to go farther, go together*. This is the belief of the FSC, and it is the means by which the NEA will work towards a better future

9. International perspective

Lucie Steinerová conveyed the gratitude of the international FSC visitors. Each nation has its own challenges but there are common topics and issues to be addressed. The delegates found that the discussions at the 10th National Forum on Stakeholder Confidence Workshop had been very focused, sophisticated and constructive. Memory keeping and knowledge transfer, ethics and sustainability of decisions were all well described and considered in a lively way. The Swiss clearly knew how to ask questions to help the foreign visitors share information and solutions. Invited in this way to form an actual international community, feeling that as the workshop went on they gained deeper understanding and connection, the FSC delegates also had fun.

According to the FSC observers, the Swiss process is transparent. It gives clear rules and phases, and each stakeholder can find the way to get involved. Of interest for further exploration would be the practical operation of regional conferences and the details of the sectoral plan process.

The FSC delegates thanked the Swiss participants for spending 3 days with their guests in Bern, some individuals taking holidays from work to be able to attend the workshop. They appreciated that the stakeholders felt it was an important use of their time.